

Retrieval of HCl and HNO₃ Profiles from FTIR Data Using SFTT2

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Abstract. A recently developed algorithm, SFTT2, is used to assess profile information available in ground-based FTIR measurements of HCl and HNO₃, and to analyze spectra recorded at Lauder, New Zealand, and Arrival Heights, Antarctica. It is shown that the altitude range of HCl retrievals may be extended by using multiple spectral lines. A preliminary analysis of a five year record of HNO₃ at Lauder shows that the Pinatubo aerosol caused a large increase of HNO₃ in a layer at about 20-30 km while having little effect at lower altitude.

1. Introduction

It has long been understood that ground-based infrared Fourier transform (FTIR) spectra contain information on the altitude profile of the absorbing molecules in the details of the observed lineshape. The current work is part of an ongoing attempt to exploit this information by applying techniques previously used on ground-based microwave emission measurements (e.g. Connor et al., 1995). Results of ozone profile retrievals with SFTT2 have appeared in Pougatchev et al., 1995 and 1996.

SFTT2 is a radiative transfer and profile retrieval algorithm for use with spectra recorded in solar absorption. One or more spectral windows recorded at one or more zenith angles are fit simultaneously. The goodness-of-fit to the measured spectra is controllable, and may vary arbitrarily in different spectral intervals. 1 or 2 trace gas profiles as well as column amounts of interfering species, instrumental background parameters, wavelength calibration factors, and an instrumental lineshape parameter may be retrieved.

2. Theoretical results

Ground-based FTIR measurements contain profile information primarily because of the pressure broadening of the spectral lines. This fact limits vertical resolution to about a pressure scale height, and usually limits the altitude range of the retrieved profile to approximately the region where the pressure width is